Beyond Gravity™
Science In Space

DreamSpace™ Group

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NASA - CRUSR - SUBORBITAL RESEARCH PROGRAM - RFI

Beyond Gravity™
Sub Orbital Scientific Launch Capability – V3.0 Public

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DreamSpace™ Group – Introduction:

General information on Beyond Gravity™ and its parent company, DreamSpace™ Group, is outlined on the last page of this document.

The following describes the scientific payload suborbital launch capabilities of the DreamSpace™ Group. Man tended research; unmanned research payloads as well as specialty flight training capabilities are described.

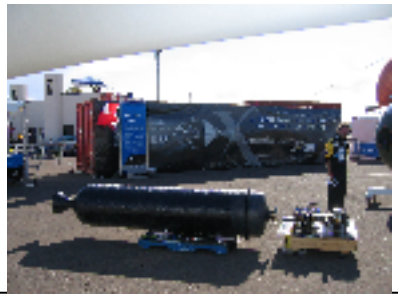
Brief History:

First Suborbital Demonstrator Spacecraft 2001

The DreamSpace™ Group was founded in 1996. Its initial roots were the da Vinci Project, an XPRIZE Competitor. The DreamSpace™ Group has been engaged in commercial manned suborbital launch systems development for the past 13 years.

Achievements include significant full scale flight hardware development and rocket engine testing. Additionally we were the second private group in the world (2004) to receive a full manned suborbital launch authorization from the government (Canada) including putting in place a US $25,000,000 third party liability insurance policy.

Hybrid Rocket Engine Test Firing



Full Scale 18,000 lbs Thrust Hybrid Engine

3 Man Suborbital Rocket 2005

The DreamSpace™ Group's present focus is on the development of its XF1 line of manned suborbital spacecraft for space tourism and scientific experimental research. The scientific research flights will be conducted by Beyond Gravity™, a DreamSpace™ Group subsidiary company.

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Suborbital Flight Capabilities and Payload Opportunities:

XF1 – Spacecraft and Mission General Description:

There are two models of the XF1 spacecraft. The XF1-A is a manned suborbital technology flight demonstrator that can also carry a scientific suborbital payload as well as conduct additional flight research activities.

The XF1-B is the full commercial passenger carrying spacecraft that also offers significant suborbital payload research capabilities, large external payloads including small orbital payload launch and research capabilities.

Most of the operational characteristics for the XF1-A and XF1-B are the same and are listed in XF1-B section further below.

Both the XF1 vehicles are aircraft style winged single pilot suborbital spacecraft that operate off of a runway for takeoff and landing. The XF1-A is a smaller 50% scale version of the XF1- B and uses a detachable (recoverable) turbojet engine / flight boost pod to assist it in attaining its approximate 40,000 ft rocket engine ignition air launch altitude.

The XF1- B is a completely single stage spacecraft with a fully integrated combined cycle rocket engine. Both spacecraft are designed for operations generally out of plus minus 5,000 ft runways. Higher gross weights and or runway altitude may dictate longer runways.

They use LOX RP1 fueled rocket engines (later a 100% CO2 neutral bio derived fuel as available - example algae based bio fuel).

XF1-A

The XF1-A is a small, single pilot flight technology demonstrator suborbital spacecraft. Operating off of a runway, it is self propelled to its launch altitude of 40,000 ft using a turbojet powered flight pod. The flight pod is detachable and recoverable. Recovery of the XF1-A is glide back to the runway. It also has full craft emergency parachute recovery capability.

- Scientific payload capability is 50 Kgs or 110 lbs to 100 kms plus.
- Payload bay is 2 ft wide by 2 ft deep by 1 ft in length. The top hatch area is 1 ft by 2ft.
- The payload bay can be either pressurized or unpressurized. The hatch can be replaced with a varied number of transparent surfaces to meet customer's needs.
- Pricing for fast rack style research flights of 50Kgs (110 lbs) to 100 kms plus are $49,900 for a full flight.
- Pricing for special operations at other locations, longer payload installation times, externally mounted payloads (not in the external bay) etc can be quoted on request.
- First flight is expected in the latter part of 2010 with operational readiness in 2011.

XF1-B

The XF1- B is a completely single stage spacecraft with a fully integrated combined cycle rocket engine. It is designed for operations generally out of plus minus 5,000 ft runways. Higher gross weights and or runway altitude may dictate longer runways.

The XF1-B has a large generally delta plan form main wing with a forward delta wing all moving canard and aft stabilizer fins / elevators. Total wing and fuselage area allows for lower G, thermal and pressure load reentry especially from the higher altitudes. It also has a small turbine engine for added range and or go around capability for its runway landings.

In its commercial space tourism configuration it can carry either a single passenger or two passengers seated side by side. The XF1-B has a very large generally ovoid shaped cabin / cockpit. One might describe it as an F16 cockpit on steroids. The one piece multi layer canopy provides an unparalleled view and experience. The pilot is in the rear and passengers are in the front. Seat(s) recline into the cabin floor to maximize float volume.

The pilot's avionics panels are located on the left and right hand sides of the cockpit along with side stick controllers which creates a large opening directly in front of the pilot to access the balance of the cockpit. Foot pedals for instance are tucked under a ramp, hidden visually from the passengers.

Generally the passenger and or interior payload section is approximately 10ft of length by maximum 6 ft of width and 5ft of height providing ample volume for flotation, movement and unobstructed fighter cockpit style oversized canopy viewing. The pilot's area is in addition to this.

The entire cockpit is also designed as a module allowing flexibility in mission design. A cockpit module can be changed out in less than a day. The cockpit module is also part of the emergency escape and recovery system. It can separate from the main body of the XF1 spacecraft at anytime in the mission flight profile and land under its own parachute. Backup parachutes are also provided for each occupant. Additionally there is a full craft emergency parachute recovery system.

Scientific payload modules can be accommodated in either the cockpit and or external payload bay (see further below for details).

The XF1-B employs a combined cycle rocket engine and turbojet engine for different parts of the flight profile / mission. Generally full rocket engine power is used at its launch altitude of typically 50,000 feet plus, for maximum final altitude and zero G time in space. The turbojet engine allows the flexibility for operations out of multiple airports, non rocket based flight training in conventional airspace etc.

In addition to flying itself to a launch destination, the XF1-B can be shipped in either two 40ft shipping containers with quick detach wings removed, single C130 or larger cargo aircraft.

XF1-B Capabilities:

- Gross payload weight available to customers when no one else is onboard (other than our pilot) – 500 lbs to approximately 2000 lbs.
- Customer tended payload weight 250 lbs (250 lbs is allocated to the customer flying with their own payload).
- Altitude 100 kms plus with 500 lbs gross payload
- Altitude 120 kms plus with 375 lbs gross payload

- Altitude 140 kms plus with 250 lbs gross payload with correspondingly longer zero G time
- Altitude 80 kms with ~ 1000 lbs gross external payload slung under / on top of spacecraft
- Altitude 50 kms with ~ 2000 lbs gross external payload slung under / on top of spacecraft
- Internal payload bay measures about 180 ft3 gross volume, irregular ovoid in shape 10ft long x 6ft wide x 5ft in depth.
- 3 NASA fast racks 3ft L x 1.5ft W x 3ft H or similar can be accommodated internally. Custom payload configurations can be accommodated to maximize volume use.
- The external (vacuum) bay is approximately 3ft L x 2ft W x 3ft H or approximately NASA fast rack capable. It has its own hatch that can be opened to allow the experiment(s) to either be ejected and or visual access to space. It is located in the top of the fuselage just aft of the cockpit.
- The external bay can also be pressurized and the hatch replaced with a number of alternative view ports made of transparent materials to accommodate customer's needs.
- Man tended payloads can be either in the cockpit with the customer or in the external bay.
- The total number of payloads is flexible within the normal fast rack mounting points. There are 3 fast racks internally. Multiple payloads can be accommodated within a single fast rack as per the maximum dimension limits currently set at 3 ft L x 1.5ft W x 3ft H for each rack.
- Total number of scientific payload "passenger" specialist is 2. Total gross payload including the specialist not to exceed 500 lbs for 100 kms plus. Higher weights to lower altitudes are possible as described above.
- Flight frequency is 4 to 8 flights per day, night flights -- 4 to 5 days per week operations, the balance being for maintenance.
- Flight locations will be initially both in the United States out of Mojave Spaceport California, New Mexico Spaceport America and a location in Canada – likely Ontario North Bay airport (TBA). Other US locations will be considered as they come on stream.
- In general the XF1 spacecraft can operate from any suitable runway of approximately 5000 ft where there is the capability for supply logistics (air based if necessary) and range safety. An operational facility on Ellesmere Island in northern Canada is also contemplated.
- The typical flight duration from wheels up to wheels down is about 1 hour (less if customer needs dictate). Zero G space time is altitude dependant – about 3.5 minutes of zero G at 100 kms increasing with altitude.
- Payloads are limited to about 3.5 G through the launch phase and 5 G on reentry. Minimum vibration is a passenger design point for the missions.
- Payloads in the cabin are subject to 10 psia pressure and 20 C temperatures. External payloads can be kept at vacuum through 14.7 psia (runway / airport pressure altitude).

- Payloads are accessible up to one hour prior to departure and within 30 minutes of landing. Beyond Gravity™ personnel will load the payload onto the XF1-B spacecraft within 20 minutes of departure and unload within 20 minutes of landing. Special requests can be considered for accessibility within the 1 hour departure window.

- Payloads flown with the payload specialist on board are accessible within the limits of their location, remote control access etc.

- External payloads can have an optical port on the hatch of a material to accommodate the experiment, full vacuum as required, hatch opening, payload ejection, sample port etc.

- Flight specialists that accompany their payloads and or are part of the experiment are allocated a weight of approximately 210 lbs plus flight suit etc for a total of 250 lbs each (500 lbs gross payload to 100 kms plus – a heavier person can be accommodated within the gross 500 lbs weight limit). The cabin is very large so specialist height and breadth etc are not normally a factor.

- The Payload specialist can leave their seat(s) during the flight for zero G float, access to their experiment(s) etc. The volume is generous as the seats fold down into the floor. Certain mobility limitations may apply depending on the nature of any onboard experiments.

- Specialist flight training is the same as will be provided for commercial space tourism passengers and is included in the prices further below. There may be additional training costs depending on specialist flight requirements.

- A secondary external payload section exists beneath and on top of the XF1 fuselage. This can accommodate up to approximately 2000 lbs gross weight allowing payloads such as secondary launch vehicles for nano to microsat to orbit or payload containment within a bay either provided by us or the customer.

- Beyond Gravity™ has a program to develop an airlaunched single stage rocket / satellite capability in the 20 kg to 50 kg range (45 lbs to 110 lbs). The microsat launcher is carried under the belly of the XF1 to a launch altitude of about 50 kms. This launcher will also serve as the company's single stage recoverable / reusable development test bed.

- A specially designed cockpit module can be changed out and installed to allow flight training in the space environment – i.e. 2 sets of full flight controls installed.

- Other airport locations specifically chosen by the customer such as NASA and or the US military can be accommodated including international locations.

- The mission execution approach of the DreamSpace™ Group is to provide scientific payload launch capabilities to its customers along side our space tourism operations. In that regard a "plug and play" approach is being taken to adopting the NASA fast rack approach. Customers can either lease or purchase a fast rack of our design with or without power, telemetry, data gathering installed etc. This allows the customer to fully test all payload functions in advance, seal it for transportation to be installed in the XF1. The fast rack will be designed to accommodate a plug in installation and removal into the XF1 in 20 minutes or less.

- Quoted payload weights are gross. For net available payload weight one must deduct the weight of each fast rack estimated at about 10 lbs net empty. The weight of fast racks

which include a package of telemetry and data gathering, transmission equipment, unique instrumentation, power etc will be developed as the program proceeds.

- No experiments can be carried on flights with other space tourism passengers on board. All Scientific research flights are dedicated. Shared experimental flights are allowed to keep costs down.

Pricing – Full Flight

- Pricing for unmanned (no specialist onboard) fast rack style research flights that occur around normal space tourism operations are $89,000 for a full flight. (i.e. You have the full use of the craft, number of payloads, weight and volume. Eg. 4 fast racks – 3 internal and one in the external bay totaling 500 lbs -100 kms plus – would cost $22,250 per fast rack payload. If each fast rack were to contain 2 separate experiments, this would translate to $11,125 per experimental flight – that's an average of 62.5 lbs and 7 ft3 per experiment.

- The above pricing is based on a single customer buying the entire flight. Loading and unloading "must" be within the time frequency scope of space tourism based operations – loading and unloading by Beyond Gravity™ personnel within 20 minutes prior to departure and unloading within 20 minutes post landing. The single customer is responsible for all multiple experiment payload consolidation, delivery to and from launch location etc.

- Pricing for flight specialists that accompany their payload(s) and or are part of the experiment are the same at $89,000 i.e. full flight and within space tourism scope operations and launch locations.

Pricing – Half Flight (manned by space flight specialist)

- Pricing for an onboard payload specialist that does NOT exceed the 250 lbs maximum gross weight inclusive of flight suit etc, any onboard and or external experimental payload for 100 kms plus altitude is priced at $49,900. This pricing is based on the availability of a second customer purchasing the other half of the flight at the same $49,900 price. Both customers must agree in advance on the acceptance of each other onboard the flight including the nature of any of the experiment(s).

- Pricing for special and or flight operations at non DreamSpace™ Group prime locations, longer payload installation times, longer unloading times, unique flight profiles, special requirements, externally mounted payloads (not in the external bay), additional training not covered under our normal flight training program, special external bay optics (other than our baseline (TBA), use of the flight training module etc are in addition and can be quoted on request.

- All pricing and flight operations characteristics are subject to final confirmation, changes in currency valuations etc.

- Operational readiness for the XF1-B is expected in the latter part of 2011 for scientific suborbital flights (non customer man tended) and sometime in 2012 for full man tended / space tourism operations.

DreamSpace™ Group is carrying out its suborbital research program under the Groups company:

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A dedicated scientific payload specialist will be available to the customer throughout all phases of the program from initial payload launch inquiry, technical queries, through launch execution and payload recovery.

XF1-A initial design released 2006 – Roll out in 2010

General Information:

For further information about Beyond Gravity™ and its parent company, DreamSpace™ Group go to www.dreamspacegroup.com

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